

FORM PTO-1390 (REV 12-29-99)		U.S. DEPARTMENT OF COMMERCE PATENT AND TRADEMARK OFFICE	ATTORNEY'S DOCKET NUMBER KC-043
TRANSMITTAL LETTER TO THE UNITED STATES DESIGNATED/ELECTED OFFICE (DO/EO/US) CONCERNING A FILING UNDER 35 U.S.C. 371			U.S. APPLICATION NO. (If known, see 37 CFR 1.5) 09/600902
INTERNATIONAL APPLICATION NO. PCT/GB99/03907	INTERNATIONAL FILING DATE 24 NOV 1999	PRIORITY DATE CLAIMED 24 NOV 1998	
TITLE OF INVENTION PIPELINE PIG			
APPLICANT(S) FOR DO/EO/US Keith LAKER			
Applicant herewith submits to the United States Designated/Elected Office (DO/EO/US) the following items and other information:			
<ol style="list-style-type: none"> 1. <input checked="" type="checkbox"/> This is a FIRST submission of items concerning a filing under 35 U.S.C. 371. 2. <input type="checkbox"/> This is a SECOND or SUBSEQUENT submission of items concerning a filing under 35 U.S.C. 371. 3. <input checked="" type="checkbox"/> This express request to begin national examination procedures (35 U.S.C. 371(f)) at any time rather than delay examination until the expiration of the applicable time limit set in 35 U.S.C. 371(b) and PCT Articles 22 and 39(1). 4. <input type="checkbox"/> A proper Demand for International Preliminary Examination was made by the 19th month from the earliest claimed priority date. 5. <input type="checkbox"/> A copy of the International Application as filed (35 U.S.C. 371(c)(2)) <ol style="list-style-type: none"> a. <input type="checkbox"/> is transmitted herewith (required only if not transmitted by the International Bureau). b. <input type="checkbox"/> has been transmitted by the International Bureau. c. <input type="checkbox"/> is not required, as the application was filed in the United States Receiving Office (RO/US). 6. <input type="checkbox"/> A translation of the International Application into English (35 U.S.C. 371(c)(2)). 7. <input type="checkbox"/> Amendments to the claims of the International Application under PCT Article 19 (35 U.S.C. 371(c)(3)) <ol style="list-style-type: none"> a. <input type="checkbox"/> are transmitted herewith (required only if not transmitted by the International Bureau). b. <input type="checkbox"/> have been transmitted by the International Bureau. c. <input type="checkbox"/> have not been made; however, the time limit for making such amendments has NOT expired. d. <input type="checkbox"/> have not been made and will not be made. 8. <input type="checkbox"/> A translation of the amendments to the claims under PCT Article 19 (35 U.S.C. 371(c)(3)). 9. <input checked="" type="checkbox"/> An oath or declaration of the inventor(s) (35 U.S.C. 371(c)(4)). 10. <input type="checkbox"/> A translation of the annexes to the International Preliminary Examination Report under PCT Article 36 (35 U.S.C. 371(c)(5)). 			
Items 11. to 16. below concern document(s) or information included:			
<ol style="list-style-type: none"> 11. <input type="checkbox"/> An Information Disclosure Statement under 37 CFR 1.97 and 1.98. 12. <input checked="" type="checkbox"/> An assignment document for recording. A separate cover sheet in compliance with 37 CFR 3.28 and 3.31 is included. 13. <input checked="" type="checkbox"/> A FIRST preliminary amendment. <input type="checkbox"/> A SECOND or SUBSEQUENT preliminary amendment. 14. <input type="checkbox"/> A substitute specification. 15. <input type="checkbox"/> A change of power of attorney and/or address letter. 16. <input checked="" type="checkbox"/> Other items or information: <ol style="list-style-type: none"> 1. Copy of Published International Application 2. Verified Statement Claiming Small Entity Status-Small Business Concern 			

U.S. APPLICATION NO. (if known, see 37 CFR 1.5)		INTERNATIONAL APPLICATION NO PCT/GB99/03907		ATTORNEY'S DOCKET NUMBER KC-043	
<div>09/600902</div> <div>17. <input checked="" type="checkbox"/> The following fees are submitted: BASIC NATIONAL FEE (37 CFR 1.492 (a) (1) - (5)) : Neither international preliminary examination fee (37 CFR 1.482) nor international search fee (37 CFR 1.445(a)(2)) paid to USPTO and International Search Report not prepared by the EPO or JPO \$970.00 International preliminary examination fee (37 CFR 1.482) not paid to USPTO but International Search Report prepared by the EPO or JPO \$840.00 International preliminary examination fee (37 CFR 1.482) not paid to USPTO but international search fee (37 CFR 1.445(a)(2)) paid to USPTO \$690.00 International preliminary examination fee paid to USPTO (37 CFR 1.482) but all claims did not satisfy provisions of PCT Article 33(1)-(4) \$670.00 International preliminary examination fee paid to USPTO (37 CFR 1.482) and all claims satisfied provisions of PCT Article 33(1)-(4) \$96.00 ENTER APPROPRIATE BASIC FEE AMOUNT = \$ 840.00 Surcharge of \$130.00 for furnishing the oath or declaration later than <input type="checkbox"/> 20 <input type="checkbox"/> 30 months from the earliest claimed priority date (37 CFR 1.492(e)). \$ CLAIMS NUMBER FILED NUMBER EXTRA RATE Total claims 19 - 20 = 0 X \$18.00 \$ Independent claims 2 - 3 = 0 X \$78.00 \$ MULTIPLE DEPENDENT CLAIM(S) (if applicable) + \$260.00 \$ TOTAL OF ABOVE CALCULATIONS = \$ 840.00 Reduction of 1/2 for filing by small entity, if applicable. A Small Entity Statement must also be filed (Note 37 CFR 1.9, 1.27, 1.28). \$ 420.00 SUBTOTAL = \$ 420.00 Processing fee of \$130.00 for furnishing the English translation later than <input type="checkbox"/> 20 <input type="checkbox"/> 30 months from the earliest claimed priority date (37 CFR 1.492(f)). \$ TOTAL NATIONAL FEE = \$ 420.00 Fee for recording the enclosed assignment (37 CFR 1.21(h)). The assignment must be accompanied by an appropriate cover sheet (37 CFR 3.28, 3.31). \$40.00 per property + \$ 40.00 TOTAL FEES ENCLOSED = \$ 460.00 Amount to be refunded: \$ charged: \$</div>				CALCULATIONS PTO USE ONLY	
a. <input checked="" type="checkbox"/> Checks in the amount of \$420.00 and \$40.00 to cover the above fees are enclosed.					
b. <input type="checkbox"/> Please charge my Deposit Account No. _____ in the amount of \$ _____ to cover the above fees. A duplicate copy of this sheet is enclosed.					
c. <input checked="" type="checkbox"/> The Commissioner is hereby authorized to charge any additional fees which may be required, or credit any overpayment to Deposit Account No. <u>16-0607</u> . A duplicate copy of this sheet is enclosed.					
NOTE: Where an appropriate time limit under 37 CFR 1.494 or 1.495 has not been met, a petition to revive (37 CFR 1.137(a) or (b)) must be filed and granted to restore the application to pending status.					
SEND ALL CORRESPONDENCE TO: FLESHNER & KIM, LLP P. O. Box 221200 Chantilly, Virginia 20153-1200					
				SIGNATURE. NAME Daniel Y. J. Kim	
REGISTRATION NUMBER 36,186					

21-Jul-00 12:48 From-KENNEDY COMPANY

+01412266838

T-061 P.02/05 F-068

Filed or Issued: _____

For: _____

**VERIFIED STATEMENT (DECLARATION) CLAIMING SMALL ENTITY
STATUS (37 CFR 1.9(d) and 1.27(c) - SMALL BUSINESS CONCERN**

I hereby declare that I am

☐ the owner of the small business concern identified below;☐ an official of the small business concern empowered to act on behalf of the concern identified below;NAME OF CONCERN Hamdeen LimitedADDRESS OF CONCERN Unit 12, Riverside Business Centre, North Esplanade West,Aberdeen AB11 5RJ, Scotland, United Kingdom

I hereby declare that the above identified small business concern qualifies as a small business concern as defined in 13 CFR 121.3.15 and reproduced in 37 CFR(d) for purposes of paying reduced fees under Section 41(a) and (b) of Title 35 United States Code, in that the number of employees of the concern, including those of its affiliates, does not exceed 500 persons. For purposes of this statement, (1) the number of employees of the business concern is the average over the previous fiscal year of the concern of the persons employed on a full-time, part-time or temporary basis during each of the pay periods of the fiscal year; and (2) concerns are affiliates of each other when either, directly or indirectly, one concern controls or has the power to control the other, or a third party or parties controls or has the power to control both.

I hereby declare that rights under contract or law have been conveyed to and remain with the small business concern identified above with regard to the invention entitled Pipeline pigKeith Laker

by inventor(s)

described in

☒ the specification filed herewith☐ application serial no _____

filed

☐ patent no _____

issued

If the rights held by the above identified small business concern are not exclusive, each individual, concern or organization having right to the invention is listed below and no rights to the invention are held by any person, other than the inventor, who could not qualify as a small business concern under 37 CFR 1.9(d) or by any concern which would not qualify as a small business concern under 37 CFR 1.9(d) or a nonprofit organization under 37 CFR 1.9(e).

NOTE: Separate verified statements are required from each named person, concern or organization having rights to the invention availing to their status as small entities (37 CFR 1.27)

NAME _____

ADDRESS _____

☐ INDIVIDUAL ☐ SMALL BUSINESS CONCERN ☐ NON PROFIT ORGANISATION

NAME _____

ADDRESS _____

☐ INDIVIDUAL ☐ SMALL BUSINESS CONCERN ☐ NON PROFIT ORGANISATION

I acknowledge the duty to file, in this application or patent, notification of any change in status resulting in loss of entitlement to small entity status prior to paying, or at the same time paying, the earliest of the issue fee or any maintenance fee due after the date on which status as a small entity is no longer appropriate (37 CFR 1.28(b)).

I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code, and that such willful false statements may jeopardize the validity of the application, any patent issuing thereon, or any patent to which this verified statement is directed.

NAME OF PERSON SIGNING Keith LakerTITLE OF PERSON OTHER THAN OWNER DirectorADDRESS OF PERSON SIGNING 1 Piersteps, St Peter Port, Guernsey GY1 2LR, United Kingdom

SIGNATURE _____

DATE

21-7-00

09/600902

534 Rec'd PCT/PTO 24 JUL 2000
PATENT

Docket No.: KC-043

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re Application of :
Keith LAKER :
Serial No. : Not yet assigned : Group Art Unit: Not yet assigned
Filed: July 24, 2000 : Examiner: Unknown
For: PIPELINE PIG :

PRELIMINARY AMENDMENT

Assistant Commissioner for Patents
Washington, D. C. 20231

Sir:

Prior to initial examination on the merits, please amend the above-identified application as follows:

IN THE CLAIMS:

Please amend claims 3-10 as follows:

3. (Amended) A pig as claimed in [any one of the preceding Claims] Claim 1 wherein the blades are designed to scrape the internal surfaces of the tubular bor upon rotation and passage of the pig.

4. (Amended) A pig as claimed in [any one of the preceding Claims] Claim 1 wherein the pig may be adapted to act as a means for the mechanical application of a coating and passage of the pig.

5. (Amended) A pig as claimed in [any one of the preceding Claims] Claim 1 wherein the blades are afforded a turbine or impeller like profile and have reaction surfaces adapted for the forward propulsion of the pig under the influence of a positive pressure applied by propulsion fluid [travelling] traveling through the tubular.

6. (Amended) A pig as claimed in [any one of the preceding Claims] Claim 1 wherein the blade design allows sufficient fluid by-pass to allow the debris removed from the tubular bore and suspended in the pumped fluid to be flushed ahead of the pig.

7. (Amended) A pig as claimed in [any one of the preceding Claims] Claim 1 wherein the blades are shaped in such a manner that they are separated by void areas which permit the relative flow of fluid through the pig in a forward direction.

9. (Amended) A pig as claimed in [any one of the preceding Claims] Claim 1 wherein the largest blade has a diameter greater than the internal diameter of the tubular.

10. (Amended) A pig as claimed in claim [9] 1 wherein [the largest blade] if the blade has a greater diameter than the internal diameter of the tubular it is sufficiently flexible to allow entry and passage of the pig through the tubular.

Please delete claims 11-16, without prejudice or disclaimer.

Please add the following new claims 17-25:

--17. A pig as claimed in Claim 1 wherein the blades are provided in a material that is relatively hard and resistant to wear.--

--18. A pig as claimed in Claim 1 wherein the blades are manufactured from composite, such as devlar, carbon or glass fiber.--

--19. A pig as claimed in Claim 1 supported on a pipe string in a well-bore.--

--20. A pig for use with a tubular bore, wherein the pig is comprised of a stabilizer body having means for connection to a mechanical driving means, which supports a

plurality of blades, each blade having a fixed diameter, wherein the combination of blades have a watermelon shaped profile.--

--21. A pig as claimed in Claim 14 wherein said pig provides simultaneous centralization and scraping of the internal surfaces of a tubular as the pig is conveyed mechanically through the tubular.--

--22. A pig as claimed in Claim 14 wherein the blade properties are selected to be adapted to flex through a profiled restriction in the tubular bore thereby providing a means of confirming the position of the pig within the tubulars.--

--23. A pig as claimed in Claim 14 wherein the blades are provided in a material that is relatively hard and resistant to wear.--

--24. A pig as claimed in Claim 14 wherein the blades are manufactured from composite, such as kevlar, carbon or glass fiber.--

--25. A pig as claimed in Claim 14 supported on a pipe string in a well-bore.--

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REMARKS

Claims 1-10 and 17-25 are pending. Claims 3-7 and 9-10 have been amended to eliminate the multiple dependency. Claims 11-16 have been cancelled without prejudice or disclaimer. Prompt examination and allowance in due course are respectfully solicited.

Respectfully submitted,
FLESHNER & KIM, LLP

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PIPELINE PIG

This invention generally relates to mechanical pigging devices, commonly referred to simply as "pigs", for use in pipelines or other tubulars. Such pigs are known to find utility in a diverse range of applications, including for cleaning purposes and for conveying equipment in the case, for example, of pipeline monitoring. In the present invention there is described a unique pig suitable for use in the cleaning of internal surfaces of a pipeline or tubular and, in a variation thereof, suitable for applying coatings or other fluids to the aforesaid surfaces.

It is known in the art to cause cleaning pigs to be propelled through a pipe or tubing under the influence of a pressurised fluid. Pigs, designed for this purpose, typically have a flexible cylindrical body made, for example, from a polyurethane foam. Other materials have also commonly been used, including rubber, metal, plastics and combinations and composites. The rear and front end walls of the cylindrical body may be covered with an impervious coating designed to form a moving seal with the inner wall of the pipe. With this design, the pig essentially acts as a piston as it is conveyed through the pipeline or tubular; the fluid on its rear side having a higher pressure head than the fluid at its front side.

Notably, pigs propelled through pipelines or the like in the manner described above are intended to prevent propelling fluid from flowing through or around the pig. Implicated by this, pigs used for cleaning purposes have, in the past, been intended to physically push and

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1 forceout debris in advance of the pig as it travels
2 through the pipe bore. At best, the pig itself provides
3 an additional wiping function on the pipe walls.

5 In the present invention it is recognised that, on
6 occasion, it would be advantageous to provide a more
7 rigorous cleaning process to a pipeline bore than merely
8 pushing loose debris and wiping the surfaces. In the
9 art, those who have addressed this problem have
10 contemplated the provision of scratching elements, such
11 as wire bristles, on the circumferential walls of the
12 pig. While related designs provide for a more aggressive
13 cleaning process, such pigs usually do not allow for
14 sufficient fluid flow past the bristles to allow for the
15 bristles themselves to be cleaned. In use, debris,
16 shavings, slivers and the like can become lodged between
17 the bristles, serving to reduce the efficiency of the
18 pig's travel and the cleaning process.

20 An object of the present invention is to obviate or at
21 least mitigate these and other disadvantages associated
22 with pipeline or tubular cleaning pigs. In one aspect,
23 the invention seeks to achieve this by creating an
24 alternative means for the propulsion of the pig through
25 the pipeline or other tubular.

27 A further object of the invention herein is to employ the
28 novel propulsion features disclosed herein in relation to
29 pigs for use in respect of other functions, including
30 pigs intended to act as mechanical applicators.

32 According to a first aspect of the present invention
33 there is provided a pig for use in a tubular bore,
34 wherein the pig is provided with one or more blades

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1 having a profile that encourages both forward movement
2 and rotation about a longitudinal axis of the pig when
3 acted upon by a propulsion fluid travelling through the
4 tubular.

5

6 It is envisaged that the pig may comprise of a
7 cylindrical elongate body having an outer diameter less
8 than the internal diameter of the tubular, wherein the
9 body supports a plurality of blades.

10

11 Preferably, the pig is a cleaning pig and the peripheral
12 edges of the blades are adapted to perform a cleaning
13 function as the pig rotates and travels through the
14 tubular. More particularly, the blades of the pig are
15 designed to scrape the internal surfaces of the tubular
16 bore upon the rotation and passage of the pig. An
17 advantage may be obtained in the option of providing the
18 edges in an abrasive material. Similarly, the edges of
19 the blades may be provided in a material that is
20 relatively hard and therefore resistant to wear.

21

22 Preferably the blades are provided in composite, such as
23 kevlar, carbon, glass fibre, although any other suitable
24 material may be used.

25

26 Alternatively, however, the peripheral edges may be
27 adapted to perform alternative functions. For example,
28 the pig may be provided as a means for the mechanical
29 application of a coating or fluid to a tubular bore and,
30 optionally, the blades or at least the edges thereof may
31 support a suitable applicator material having a high
32 capacity for carrying by absorption or other means the
33 coating or fluid to be applied.

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1 According to a second aspect of the present invention
2 there is provided a pig for use in a tubular, wherein the
3 pig is comprised of a stabiliser body wherein the
4 stabiliser body supports a plurality of blades and is
5 conveyed mechanically through a tubular.

6

7 Preferably the pig is a cleaning pig wherein the blades
8 of the pig are designed to scrape the internal surfaces
9 of the tubular bore whilst the stabiliser body provides
10 centralisation.

11

12 Preferably the blades may be adapted so that they do not
13 exhibit any abrasive qualities thereby reducing the risk
14 of damage if the pig is to be used in tubing which is
15 plastic coated.

16

17 Preferably the blade properties can be pre selected to be
18 adapted to flex through a profiled restriction in the
19 tubular bore thereby providing a means of confirming the
20 position of a pig within the tubulars.

21 According to a third aspect of the present invention
22 there is provided a pig for use in a tubular, wherein the
23 pig is adapted to rotate in its longitudinal axis under
24 the influence of a propulsion fluid as it is displaced
25 through the tubular.

26

27 The pig may be further adapted to rotate in orbit within
28 the tubular bore.

29

30 According to a fourth aspect of the present invention
31 there is provided a pig for use in a tubular, the pig
32 comprising reaction surfaces adapted for forward
33 propulsion of the pig under the influence of a positive
34 pressure applied by propulsion fluid travelling through

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1 the tubular, characterised in that the reaction surfaces
2 are spaced and orientated so as to provide for a net
3 positive velocity of the propulsion fluid relative to the
4 pig in the direction of travel through the tubular.

5

6 The reaction surfaces may be provided on a plurality of
7 respective blades, such as turbine blades. Preferably,
8 the blades define a fluid by-pass path, the blades being
9 separated by void areas which permit the relative flow of
10 fluid through the pig in a forward direction.

11

12 Preferably the reaction surfaces also encourage the
13 rotation of the pig around its longitudinal axis when
14 acted upon by the propulsion fluid.

15

16 According to a fifth aspect of the present invention
17 there is provided a pig for use in a tubular, wherein the
18 pig is provided with one or more blades having a profile
19 that precludes rotation of the pig while travelling
20 through the tubular.

21

22 The blades are typically of varying diameter, the largest
23 blade or blades potentially, having a diameter greater
24 than the internal diameter of the tubular.

25

26 Preferably the largest blade or blades are sufficiently
27 flexible to allow entry and passage of the pig through
28 the tubular yet sufficiently robust to carry out and
29 withstand the rigours of the cleaning process.

30

31 It should be understood that references to tubulars
32 herein, unless the context otherwise dictates, should be
33 construed in the broadest possible sense, and interpreted
34 to encompass any form of tubing, pipe or pipeline.

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1
2 In order to provide a better understanding of the
3 invention, example embodiments of a pig incorporating the
4 invention will now be described with reference to the
5 accompanying Figures;

6
7 Figure 1 shows, in perspective view, a pig intended for
8 the cleaning of the internal surfaces of coiled tubing as
9 the pig is propelled along the tubular by a propulsion
10 fluid.

11
12 Figure 2 shows, in perspective view, a pig intended to
13 provide stabilisation and cleaning of the internal
14 surfaces of tubing as the pig is conveyed mechanically
15 along a tubular.

16
17 Referring firstly to Figure 1, a pig, generally depicted
18 at 1, comprises substantially of a body 2 and a plurality
19 of turbine blades 3. The body 2 is generally elongate
20 and cylindrical. The pig body 2 is suitably made of a
21 robust material in view of its need to withstand
22 substantial impact loads, while also functioning in an
23 aggressive cleaning manner.
24 The blades 3 are afforded a turbine or impeller like
25 profile, having reaction surfaces 4 that react to the
26 influence of a propulsion fluid pumped through the coiled
27 tubing in which the pig 1 is intended to travel. Typical
28 of turbine blades, the blades 3 can be provided on the
29 body 2 such that the reaction surfaces 4 are presented at
30 an acute angle to the linear direction of the fluid flow,
31 thereby imparting a reaction torque to the body 2 in
32 addition to a reaction force in the axial direction. In
33 consequence, the pig 1, when acted upon by a propulsion
34 fluid, is caused to travel through the coiled tubing in a

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1 generally axial direction, but to also rotate about its
2 longitudinal axis while so doing.
3
4 Additionally, the pig 1 moves in a third dynamic path.
5 The outside diameter of the pig 1 can be sized to have a
6 degree of clearance within the internal bore of the
7 tubular. That is to say, the maximum outside diameter of
8 the pig is less than the internal diameter of the
9 tubular, allowing for radial displacement of the pig 1
10 during its travel through the tubing. In fact, it is
11 recognised in the present invention, that such
12 dimensioning of the pig 1 relative to the tubing causes
13 the longitudinal axis of the pig 1 to orbit or rotate
14 about the substantially parallel longitudinal axis of the
15 tubing.

16
17 This third dynamic path is associated with a number of
18 advantages. For instance, where it is intended that the
19 peripheral edges 5 of the blades 3 contact the internal
20 surfaces of the tubing, the radial displacement of the
21 pig 1 as it orbits around the longitudinal axis of the
22 tubing allows for such contact over a range of tubing
23 diameters. This means that it is not essential that a
24 respective pig, incorporating the invention hereto, need
25 be provided to correspond to each size of coiled tubing
26 or other tubular.

27
28 In an alternative application a pipeline can be cleaned
29 using a combination of two pigs. The first pig, having
30 an outer diameter less than the internal diameter of the
31 tubular, passes through the pipeline removing major
32 restrictions. The second pig removes additional debris
33 and in effect polishes the internal surface of the
34 pipeline.

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2 A further advantage, which applies also to the other
3 rotational movement of the pig about its own axis, is
4 that the relative velocity of the blade edges 5 is
5 considerably higher relative to the tubing surfaces than
6 that of a pig merely designed for linear movement. This
7 is particularly advantageous where the pig is intended
8 for use as a mechanical cleaning device.

9

10 The cleaning pig 1 is designed to clean the internal bore
11 of coiled tubing. More particularly, the pig 1 is
12 adapted to apply a rotational cleaning action suitable
13 for removing scales and other deposits located on the
14 internal surfaces of the tubing.

15

16 In one use, the pig may be used to prepare the surface of
17 a tubular, by removing scale or rust not removed by other
18 cleaning methods, prior to the application of a coating
19 fluid or material.

20

21 Secondary cleaning of the coiled tubing is achieved by
22 the effects of disturbances in the flow of the propulsion
23 fluid through the voids between the turbine blades 3.

24

25 The interaction of the turbine blades with the propulsion
26 renders the propulsion fluid flow of a turbulent nature.
27 It will be appreciated by those skilled in the art that
28 this enhances the cleaning efficiency of the device.

29

30 Furthermore, the presence of voids between the blades 3
31 results in the propulsion fluid having a positive
32 velocity relative to the pig. As a consequence of this
33 positive velocity the propulsion fluid also removes the
34 debris created by the cleaning of the coiled tubing. The

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1 removal of this debris has the advantage of preventing
2 the build up of potential blockages in the coiled tubing.
3 Moreover, debris is also cleaned from the blades of the
4 pig itself.

5

6 In an alternative embodiment the reaction surfaces 4 and
7 most particularly peripheral edges 5 of the blades 3 are
8 provided with a material suitable for the application of
9 a coating of other fluid material.

10

10 With reference to Figure 2, an alternative embodiment of
11 the present invention generally depicted at 7 comprises a
12 stabiliser body 8 which has a plurality of blades 9
13 mounted in a similar configuration to the embodiment
14 shown in figure 1. The stabiliser body 8 has coupling
15 means 10 which allow attachment to mechanical driving
16 means (not shown) so that the stabiliser body 8 is
17 propelled through a tubular. Where the tubular is casing
18 or liner in a well-bore, the mechanical driving means may
19 be a pipe string, for example. Furthermore the blades 9
20 are mounted on the stabiliser body 8 in a watermelon
21 shaped configuration which assists entry into and
22 retrieval out of profiled restrictions.
23

24

24
25 In this manner the embodiment shown in Figure 2 allows
26 simultaneous centralisation and cleaning for coiled
27 tubing.

28

29 Further modifications and improvements may be
30 incorporated without departing from the scope of the
31 invention herein intended.

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33Claims:

1. A pig for use with a tubular bore, wherein the pig is provided with one or more blades having a profile that encourages both forward movement and rotation about a longitudinal axis of the pig when acted upon by a propulsion fluid travelling through the tubular.
2. A pig as claimed in Claim 1 wherein the pig is comprised of a cylindrical elongate body having an outer diameter substantially less than the internal diameter of the tubular, wherein the body supports a plurality of blades.
3. A pig as claimed in any one of the preceding Claims wherein the blades are designed to scrape the internal surfaces of the tubular bore upon rotation and passage of the pig.
4. A pig as claimed in any of the preceding Claims wherein the pig may be adapted to act as a means for the mechanical application of a coating or a fluid to a tubular bore.
5. A pig as claimed in any one of the preceding Claims wherein the blades are afforded a turbine or impeller like profile and have reaction surfaces adapted for the forward propulsion of the pig under the influence of a positive pressure applied by propulsion fluid travelling through the tubular.

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- 1 6. A pig as claimed in any one of the preceding Claims
2 wherein the blade design allows sufficient fluid by-
3 pass to allow the debris removed from the tubular
4 bore and suspended in the pumped fluid to be flushed
5 ahead of the pig.
6
- 7 7. A pig as claimed in any one of the preceding Claims
8 wherein the blades are shaped in such a manner that
9 they are separated by void areas which permit the
10 relative flow of fluid through the pig in a forward
11 direction.
12
- 13 8. A pig as claimed in any one of the preceding Claims
14 wherein the blades are of varying diameter.
15
- 16 9. A pig as claimed in any one of the preceding Claims
17 wherein the largest blade has a diameter greater
18 than the internal diameter of the tubular.
19
- 20 10. A pig as claimed in Claim 9 wherein the largest
21 blade is sufficiently flexible to allow entry and
22 passage of the pig through the tubular.
23
- 24 11. A pig for use with a tubular bore, wherein the pig
25 is comprised of a stabiliser body having means for
26 connection to a mechanical driving means, which
27 supports a plurality of blades, each blade having a
28 fixed diameter, wherein the combination of blades
29 have a watermelon shaped profile.
30
- 31
- 32 12. A pig as claimed in Claim 11 wherein said pig
33 provides simultaneous centralisation and scraping of

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12

1 the internal surfaces of a tubular as the pig is
2 conveyed mechanically through the tubular.

3

4 13. A pig as claimed in Claims 11 and 12 wherein the
5 blade properties are selected to be adapted to flex
6 through a profiled restriction in the tubular bore
7 thereby providing a means of confirming the position
8 of the pig within the tubulars.

9

10 14. A pig as claimed in any of the preceding Claims
11 wherein the blades are provided in a material that
12 is relatively hard and resistant to wear.

13

14 15. A pig as claimed in any of the preceding Claims
15 wherein the blades are manufactured from composite,
16 such as kevlar, carbon or glass fibre.

17

18 16. A pig as claimed in any one of the preceding Claims
19 supported on a pipe string in a well-bore.

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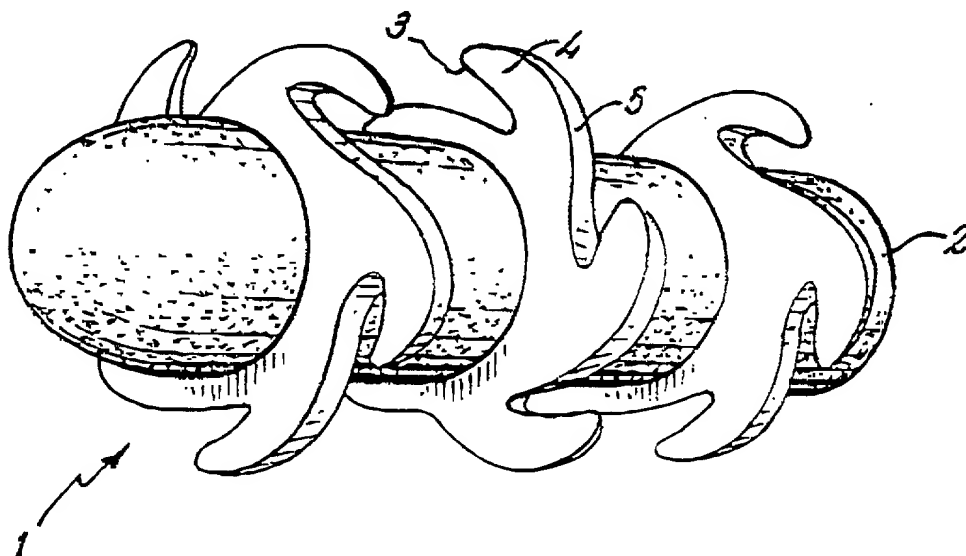
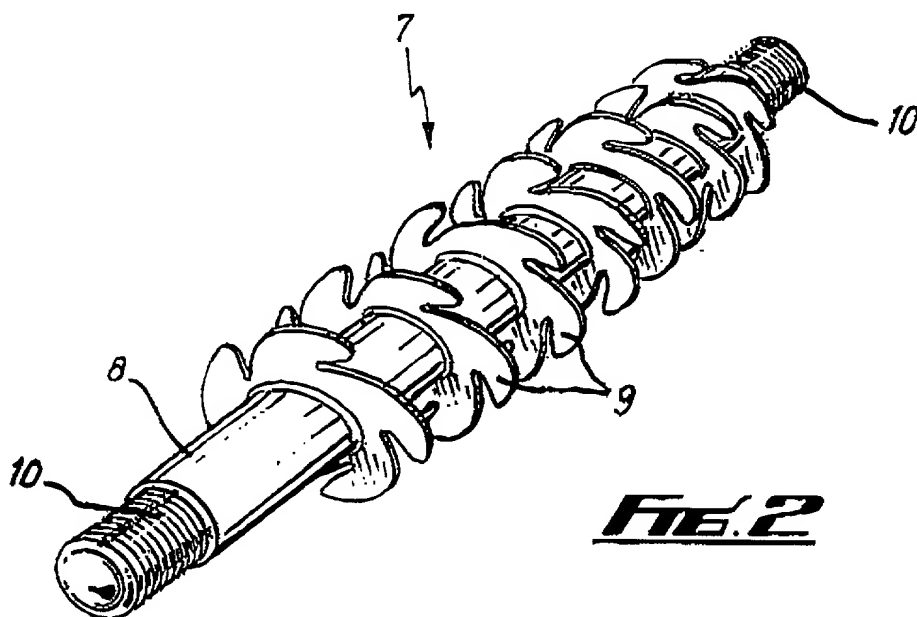
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09/600902

**FIG. 1****FIG. 2**

Prior US/PCT Applications:

(US Application Serial No)	(US Filing Date)	(Status-patented/pending/abandoned)
(US Application Serial No)	(US Filing Date)	(Status-patented/pending/abandoned)
(PCT Application No)	(US Filing Date)	(US Serial No Assigned, if any)
(PCT Application No)	(US Filing Date)	(US Serial No Assigned, if any)

I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code and that such willful false statements may jeopardize the validity of the application or any patent issued thereon.

POWER OF ATTORNEY: I hereby appoint the following attorney(s) and or agent(s): Daniel Y J Kim, Registration No 36,186 and Mark L Fleschner, Registration No 34,596; Carl R Wozolowski, Registration No 40,372, John C Elsenhart, Registration No 38,128, and Rene A Vazquez, Registration No 38,647, all of

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 Chantilly
 VIRGINIA 20153-1200, USA

with full power of substitution and revocation to prosecute this application and to transact all business in the Patent and Trademark Office connection therewith, and all future correspondence should be addressed to them.

Full name of sole or first inventor: Keith Laker Date: 21.7.00
 Inventor's Signature: [Signature] Date:
 Residence: United Kingdom
 Country of Citizenship: United Kingdom
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Gbx

21-Jul-00 12:46

From-KENNEDY COMPANY

+01412266838

T-051 P.09/05 F-058

Docket No.: _____

DECLARATION AND POWER OF ATTORNEY FOR PATENT APPLICATION

As a below named inventor, I hereby declare that:

My residence, post office and citizenship are as stated below next to my name.

I believe I am the original, first and sole inventor (if only one name is listed below) or an original, first and joint inventor (if plural names are listed below) of the subject matter which is claimed and for which a patent is sought on the invention entitled

Pipeline pig
the specification of which

- (check one) ☒ is attached hereto
- ☐ was filed on _____ as Application Serial No _____
(if applicable) and was amended on _____
- ☐ was filed as PCT International Application No _____
and was amended under PCT Article 19 on _____

I hereby state that I have reviewed and understand the contents of the above identified specification, including the claims, as amended by any amendment referred to above.

I acknowledge the duty to disclose information which is material to the examination of this application in accordance with Title 37, Code of Federal Regulations, Section 1.56.

I hereby claim foreign priority benefits under Title 35 United States Code 119 of any foreign application(s) for patent or inventor's certificate, or 365(a) of any PCT international application(s) designating at least one country other than the United States of America, listed below and have also identified below any foreign application(s) for patent or inventor's certificate or any PCT international application(s) designating at least one country other than the United States of America filed by me on the same subject matter having a filing date before that of the application(s) on which priority is claimed:

Prior Foreign / PCT Application(s)

Application No	Country/PCT	Day/Month Year Filed	Priority Claimed
0825714.0	United Kingdom	24 November 1998	Yes
PCT/GB99/03607	PCT	24 November 1998	No

I hereby claim the benefit under Title 35, United States Code, 120 of any United States application(s) or PCT international application(s) designating the United States of America that is/are listed below and, in so far as the subject matter of each of the claims by the first paragraph of Title 35, United States Code 112, I acknowledge the duty to disclose material information as defined in Title 37, Code of Federal Regulations 1.56 which occurred between the filing date of the prior application(s) and the national or PCT international filing date of this application.